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EXAMINER	
SMITH, BRADLEY	

ART UNIT	PAPER NUMBER
2891	

DATE MAILED: 07/18/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/789,736	YIN ET AL.	
	Examiner	Art Unit	
	Bradley K. Smith	2891	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 April 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-61* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-61* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *4/24/06*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☒ Other: *search notes*.

DETAILED ACTION

Claim Objections

Claim 2 is objected to because of the following informalities: the examiner does not understand " spreading gas containing nitrogen to radio frequency to spread a plasma". Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

1. Claims 1-12, 14 – 25, 27 – 34, 37 – 40, 51 – 58, and 61 are rejected under 35 U.S.C. 103(a) as being unpatentable over He *et al.* in view of Fairbairn *et al.*

Regarding claims 1-7 and 10, He *et al.* teaches a spreading gas of argon (Ar) but does not discuss other gas mixtures. Fairbairn *et al.* (US 6,841,341) teaches using nitrogen (N_2), ammonia (NH_3), Ar mixed with N_2, or helium (He) as a spreading gas [column 6, lines 1-10]. It would have been obvious to one of ordinary skill in the art to use the spreading gases of Fairbairn *et al.* in the method of He *et al.* since Fairbairn *et al.* teaches that these are equivalent material choices to Ar when forming an amorphous carbon layer.

Regarding claims 8 and 12, He *et al.* teaches using CH_4 at a flow rate of 9 sccm [Table 1], but does not discuss using propyne (C_3H_4) or butane (C_4H_{10}) or propylene

(C_3H_6) at a flow rate of 500 – 4000 sccm. Fairbairn *et al.* teaches the use of propyne, butane, and propylene at a flow rate of 500 sccm [column 6, lines 2 and 18]. It would have been obvious to one of ordinary skill in the art to use these materials since Fairbairn *et al.* teaches that these are equivalent material choices to methane for growing amorphous carbon layers and the increased flow rate provides an adjustable growth rate of the resulting layer.

Regarding claim 9, He *et al.* teaches growing the carbon layer at a temperature less than 100 °C. Fairbairn *et al.* teaches a growth temperature of between 150 and 480 °C [column 6, lines 50-55]. It would have been obvious to one of ordinary skill in the art to use the growth temperatures of Fairbairn *et al.* in the method of He *et al.* since these temperatures provide an adjustable control over the final extinction coefficient value.

Regarding claim 11, He *et al.* teaches using the carbon layer in an electronic device [pg. 1055], but does not teach using it as an insulating layer or antireflection coating (ARC). Fairbairn *et al.* teaches the use of transparent amorphous carbon layers as insulating films or ARCs in electronic devices [column 2, lines 10-15]. It would have been obvious to one of ordinary skill in the art to use the carbon layer of He *et al.* in the devices of Fairbairn *et al.* since these layers provide improved insulating and optical properties [pg. 1055].

Regarding claim 14, He *et al.* teaches a method of forming an amorphous carbon layer [pg. 1055] for a semiconductor structure by introducing a carbon containing process gas [Table 1] over a wafer to form a layer having an extinction coefficient

between 0.001 and 0.15 at a wavelength of 633 nm [Figure 5]. He *et al.* does not describe a masking structure. Fairbairn *et al.* teaches forming a masking structure [Figure 2D]. It would have been obvious to one of ordinary skill in the art to form the carbon layer of He *et al.* with the masking structure of Fairbairn *et al.* since the carbon layer would act as an improved ARC with improved pattern replication [column 2, lines 10-20].

Regarding claims 15 and 16, He *et al.* teaches a spreading gas of argon (Ar) at a flow rate of 85 sccm but does not discuss other gas mixtures at higher flow rates. Fairbairn *et al.* teaches N_2 and NH_3 [column 6, lines 1-10]. It would have been obvious to one of ordinary skill in the art to use the spreading gases of Fairbairn *et al.* in the method of He *et al.* since Fairbairn *et al.* teaches that these are equivalent material choices to Ar when forming an amorphous carbon layer where the flow rates would be determined by routine optimization during experimentation.

Regarding claim 17, He *et al.* further teaches a process gas of methane (CH_4) [pg. 1055].

Regarding claim 18, He *et al.* further discloses a process gas containing carbon and without oxygen [pg. 1056].

Regarding claim 19, He *et al.* teaches growing the carbon layer at a temperature less than 100 °C. Fairbairn *et al.* teaches a growth temperature of between 150 and 480 °C [column 6, lines 50-55]. It would have been obvious to one of ordinary skill in the art to use the growth temperatures of Fairbairn *et al.* in the method of He *et al.* since

these temperatures provide an adjustable control over the final extinction coefficient value.

Regarding claims 20 – 24, He *et al.* teaches using the carbon film in electronic device processing but does not describe forming a patterned carbon layer with an *in situ* silicon oxynitride layer which is removed with an oxygen plasma process. Fairbairn *et al.* teaches forming a patterned carbon layer [Figure 2D] with a silicon oxynitride layer **206** formed *in situ* [Figure 2B] and removed by an oxygen plasma process [column 8, lines 35-40]. It would have been obvious to one of ordinary skill in the art to use the pattern making process of Fairbairn *et al.* with the carbon layer forming method of He *et al.* since He *et al.* teaches that their method provides an amorphous carbon layer with improved optical transparency and ease of preparation.

Regarding claim 25, He *et al.* teaches using CH_4 at a flow rate of 9 sccm [Table 1], but does not discuss using propylene (C_3H_6) at a flow rate of 500 – 4000 sccm. Fairbairn *et al.* teaches the use of propylene at a flow rate of 500 sccm [column 6, lines 2 and 18]. It would have been obvious to one of ordinary skill in the art to use these materials since Fairbairn *et al.* teaches that these are equivalent material choices to methane for growing amorphous carbon layers and the increased flow rate provides an adjustable growth rate of the resulting layer.

Regarding claim 27, He *et al.* teaches a method of forming an amorphous carbon layer [pg. 1055] for a semiconductor structure by introducing a carbon containing process gas [Table 1] over a wafer to form a layer having an extinction coefficient between 0.001 and 0.15 at a wavelength of 633 nm [Figure 5]. He *et al.* does not

describe a substrate with circuits. Fairbairn *et al.* teaches forming an amorphous carbon layer on a substrate **200** with circuits. It would have been obvious to one of ordinary skill in the art to form the carbon layer of He *et al.* with the substrate of Fairbairn *et al.* since the carbon layer would act as an improved ARC with improved pattern replication [column 2, lines 10-20].

Regarding claim 28, He *et al.* teaches growing the carbon layer at a temperature less than 100 °C. Fairbairn *et al.* teaches a growth temperature of between 150 and 480 °C [column 6, lines 50-55]. It would have been obvious to one of ordinary skill in the art to use the growth temperatures of Fairbairn *et al.* in the method of He *et al.* since these temperatures provide an adjustable control over the final extinction coefficient value.

Regarding claim 29, He *et al.* further teaches a process gas of methane (CH_4) [pg. 1055].

Regarding claim 30, He *et al.* further discloses a process gas containing carbon and without oxygen [pg. 1056].

Regarding claims 31, He *et al.* teaches a spreading gas of argon (Ar) but does not discuss other gas mixtures. Fairbairn *et al.* teaches N_2 mixed with Ar [column 6, lines 1-10]. It would have been obvious to one of ordinary skill in the art to use the spreading gases of Fairbairn *et al.* in the method of He *et al.* since Fairbairn *et al.* teaches that these are equivalent material choices to Ar when forming an amorphous carbon layer.

Regarding claims 32 – 34, He *et al.* teaches using the carbon film in electronic device processing but does not describe forming a patterned carbon layer with a silicon oxynitride layer which is removed with an oxygen plasma process. Fairbairn *et al.* teaches forming a patterned carbon layer [Figure 2D] with a silicon oxynitride layer **206** and removed by an oxygen plasma process [column 8, lines 35-40]. It would have been obvious to one of ordinary skill in the art to use the pattern making process of Fairbairn *et al.* with the carbon layer forming method of He *et al.* since He *et al.* teaches that their method provides an amorphous carbon layer with improved optical transparency and ease of preparation.

Regarding claims 37 – 39, He *et al.* teaches using the carbon film in electronic device processing but does not discuss forming an ARC layer as integrated circuit with a plurality of devices. Fairbairn *et al.* teaches an ARC layer [column 2, lines 50-60] in an integrated circuit with a plurality of devices [Figure 3E]. It would have been obvious to one of ordinary skill in the art to use the amorphous carbon layer of He *et al.* in the structures of Fairbairn *et al.* since the carbon layer of He *et al.* provides improved optical transparency and ease of preparation.

Regarding claim 40, He *et al.* teaches using CH_4 at a flow rate of 9 sccm [Table 1], but does not discuss using propylene (C_3H_6) at a flow rate of 500 – 4000 sccm. Fairbairn *et al.* teaches the use of propylene at a flow rate of 500 sccm [column 6, lines 2 and 18]. It would have been obvious to one of ordinary skill in the art to use these materials since Fairbairn *et al.* teaches that these are equivalent material choices to

methane for growing amorphous carbon layers and the increased flow rate provides an adjustable growth rate of the resulting layer.

Regarding claims 51 and 61, He *et al.* teaches a method of forming an amorphous carbon layer [pg. 1055] for a semiconductor structure by introducing a carbon containing process gas [Table 1] over a wafer to form a layer having an extinction coefficient between 0.001 and 0.15 at a wavelength of 633 nm [Figure 5]. He *et al.* further describes the processing system [Figure 1] but does not teach coupling controller which is a processor to an electronic device. Fairbairn *et al.* teaches forming an amorphous carbon layer where a controller **110** is coupled to an electronic device [Figure 1] by providing a processor **112**. It would have been obvious to one of ordinary skill in the art to form the carbon layer of He *et al.* with the controller of Fairbairn *et al.* since the controller would provide proper control and regulation of the gas supplies.

Regarding claim 52, He *et al.* teaches growing the carbon layer at a temperature less than 100 °C. Fairbairn *et al.* teaches a growth temperature of between 150 and 480 °C [column 6, lines 50-55]. It would have been obvious to one of ordinary skill in the art to use the growth temperatures of Fairbairn *et al.* in the method of He *et al.* since these temperatures provide an adjustable control over the final extinction coefficient value.

Regarding claim 53, He *et al.* further teaches a process gas of methane (CH_4) [pg. 1055].

Regarding claim 54, He *et al.* further discloses a process gas containing carbon and without oxygen [pg. 1056].

Regarding claims 55, He *et al.* teaches a spreading gas of argon (Ar) but does not discuss other gas mixtures. Fairbairn *et al.* teaches N_2 mixed with Ar [column 6, lines 1-10]. It would have been obvious to one of ordinary skill in the art to use the spreading gases of Fairbairn *et al.* in the method of He *et al.* since Fairbairn *et al.* teaches that these are equivalent material choices to Ar when forming an amorphous carbon layer.

Regarding claims 56 – 58, He *et al.* teaches using the carbon film in electronic device processing but does not describe forming a patterned carbon layer with a silicon oxynitride layer which is removed with an oxygen plasma process. Fairbairn *et al.* teaches forming a patterned carbon layer [Figure 2D] with a silicon oxynitride layer **206** and removed by an oxygen plasma process [column 8, lines 35-40]. It would have been obvious to one of ordinary skill in the art to use the pattern making process of Fairbairn *et al.* with the carbon layer forming method of He *et al.* since He *et al.* teaches that their method provides an amorphous carbon layer with improved optical transparency and ease of preparation.

2. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over He *et al.* in view of Sudijono *et al.*

He *et al.* teaches a spreading gas of Ar at a flow rate of 85 sccm [Table 1], but does not discuss using He at a flow rate of between 200 and 1500 sccm. Sudijono *et al.* (US 2004/0092098) teaches a method of forming an amorphous carbon layer with a He flow rate of 100 – 1000 sccm [0034]. It would have been obvious to one of ordinary

skill in the art to use the spreading gas and flow rate of Sudijono *et al.* in the method of He *et al.* since this provides improved amorphization of the film [0034].

3. Claims 26 and 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over He *et al.* and Fairbairn *et al.* as applied to claim14 and 17 above, and further in view of Sudijono *et al.*

He *et al.* teaches a spreading gas of Ar at a flow rate of 85 sccm [Table 1], but does not discuss using He at a flow rate of between 200 and 1500 sccm. Sudijono *et al.* teaches a method of forming an amorphous carbon layer with a He flow rate of 100 – 1000 sccm [0034]. It would have been obvious to one of ordinary skill in the art to use the spreading gas and flow rate of Sudijono *et al.* in the method of He *et al.* since this provides improved amorphization of the film [0034].

4. Claims 35, 36, 42 – 50, 59, and 60 are rejected under 35 U.S.C. 103(a) as being unpatentable over He *et al.* in view of Fairbairn *et al.* and Zhou *et al.*

Regarding claims 35, 36, 59, and 60, He *et al.* as modified by Fairbairn *et al.* teaches an amorphous carbon layer in an electronic device application, but do not discuss the film in the semiconductor structure of the device as an insulation. Zhou *et al.* (Deposition and properties of a-C:H films on polymethyl methacrylate by electron cyclotron resonance microwave plasma chemical vapor deposition method) teaches an amorphous carbon layer as a passivation coating in an integrated circuit [pg. 273]. It would have been obvious to one of ordinary skill in the art to use the film of He *et al.* in the device of Zhou *et al.* since the properties of high hardness, high electric resistance, and high optical transparency are essential properties for use in semiconductor devices.

Regarding claim 42, He *et al.* teaches a method of forming an amorphous carbon layer [pg. 1055] for a semiconductor structure by introducing a carbon containing process gas [Table 1] over a wafer to form a layer having an extinction coefficient between 0.001 and 0.15 at a wavelength of 633 nm [Figure 5]. He *et al.* does not describe processing a semiconductor structure for a memory where the temperature range is 150 – 500 °C. Fairbairn *et al.* teaches a growth temperature of between 150 and 480 °C [column 6, lines 50-55]. Zhou *et al.* teaches forming the amorphous carbon layer for a integrated circuit memory structure [pg. 273]. It would have been obvious to one of ordinary skill in the art to use the growth temperatures of Fairbairn *et al.* in the method of He *et al.* since these temperatures provide an adjustable control over the final extinction coefficient value and to use the film of He *et al.* in the device of Zhou *et al.* since the properties of high hardness, high electric resistance, and high optical transparency are essential properties for use in semiconductor devices.

Regarding claim 43, He *et al.* further teaches a process gas of methane (CH_4) [pg. 1055].

Regarding claim 44, He *et al.* further discloses a process gas containing carbon and without oxygen [pg. 1056].

Regarding claims 45, He *et al.* teaches a spreading gas of argon (Ar) but does not discuss other gas mixtures. Fairbairn *et al.* teaches N_2 mixed with Ar [column 6, lines 1-10]. It would have been obvious to one of ordinary skill in the art to use the spreading gases of Fairbairn *et al.* in the method of He *et al.* since Fairbairn *et al.*

teaches that these are equivalent material choices to Ar when forming an amorphous carbon layer.

Regarding claims 46 – 48, He *et al.* teaches using the carbon film in electronic device processing but does not describe forming a patterned carbon layer with a silicon oxynitride layer which is removed with an oxygen plasma process. Fairbairn *et al.* teaches forming a patterned carbon layer [Figure 2D] with a silicon oxynitride layer **206** and removed by an oxygen plasma process [column 8, lines 35-40]. It would have been obvious to one of ordinary skill in the art to use the pattern making process of Fairbairn *et al.* with the carbon layer forming method of He *et al.* since He *et al.* teaches that their method provides an amorphous carbon layer with improved optical transparency and ease of preparation.

Regarding claims 49 and 50, He *et al.* as modified by Fairbairn *et al.* teaches an amorphous carbon layer in an electronic device application, but do not discuss the film in the semiconductor structure of the device as an insulation. Zhou *et al.* teaches an amorphous carbon layer as a passivation coating in an integrated circuit [pg. 273]. It would have been obvious to one of ordinary skill in the art to use the film of He *et al.* in the device of Zhou *et al.* since the properties of high hardness, high electric resistance, and high optical transparency are essential properties for use in semiconductor devices.

Response to Arguments

Applicant's arguments filed 4/24/06 have been fully considered but they are not persuasive. With regards to the applicant's argument that Fairbain fails to disclose a spreading gas, the examiner contends that disclose of the use of the use of He to

control the deposition would read on the use of He as a spreading gas. The applicant is reminded that Office personnel are to give claims their broadest reasonable interpretation in light of the supporting disclosure. In re Morris, 127 F.3d 1048, 1054-55, 44 USPQ2d 1023, 1027-28 (Fed. Cir. 1997). Limitations appearing in the specification but not recited in the claim are not read into the claim. E-Pass Techs., Inc. v. 3Com Corp., 343 F.3d 1364, 1369, 67 USPQ2d 1947, 1950 (Fed. Cir. 2003) (claims must be interpreted "in view of the specification" without importing limitations from the specification into the claims unnecessarily). In re Prater, 415 F.2d 1393, 1404-05, 162 USPQ 541, 550-551 (CCPA 1969). See also In re Zletz, 893 F.2d 319, 321-22, 13 USPQ2d 1320, 1322 (Fed. Cir. 1989) ("During patent examination the pending claims must be interpreted as broadly as their terms reasonably allow.... The reason is simply that during patent prosecution when claims can be amended, ambiguities should be recognized, scope and breadth of language explored, and clarification imposed.... An essential purpose of patent examination is to fashion claims that are precise, clear, correct, and unambiguous. Only in this way can uncertainties of claim scope be removed, as much as possible, during the administrative process.").

Furthermore, the applicant contends that:

> Since Fairbaim does not teach or suggest the absorption coefficient (extinction coefficient) for amorphous carbon for wavelengths above 250 nm and He does teach or suggest the effects of a spreading gas of helium or a nitrogen containing gas composition in the formation of amorphous carbon, Applicant submits that the combination of He and Fairbaim, as proffered in the Office Action, does not teach or suggest all the features in forming an amorphous carbon layer having an extinction coefficient between about 0.001 and about 0.15 at a wavelength of 633 nanometers as recited in claim 1 .

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Furthermore an both references disclose forming an amorphous carbon layer, and since the amorphous carbon layer in Fairbaim and He is structurally the same as the claimed amorphous carbon layer it would stand to reason that the carbon layer would have the same extinction coefficient at a specific wavelength.

With regards to the applicants arguments that He et al and Sudijomo et al. fail to disclose the amorphous carbon layer with a particular extinction coefficient. The examiner would like to point out that both disclose forming a amorphous carbon film and inherently it would have the same extinction coefficient at the same wavelength because they have the same structure (or lack thereof).

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the

shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Bradley K. Smith whose telephone number is 571-272-1884. The examiner can normally be reached on 10-6.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bill Baumeister can be reached on 571-272-1722. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Bradley K Smith
Primary Examiner
Art Unit 2891